WHAT IS CLAIMED IS:

1. A method for purifying single-wall carbon nanotubes comprising:
   (a) oxidizing a single-wall carbon nanotube material in an oxidizing gaseous atmosphere; and
   (b) treating the single-wall carbon nanotube material with a halogen-containing gas.
2. The method of claim 1, wherein the oxidizing gaseous atmosphere comprises a gas selected from the group consisting of oxygen, carbon dioxide, and mixtures thereof.
3. The method of claim 1, wherein the oxidizing gaseous atmosphere comprises water vapor.
4. The method of claim 1, wherein the oxidizing gaseous atmosphere comprises oxygen and water vapor.
5. The method of claim 1, wherein the oxidizing gaseous atmosphere comprises carbon dioxide.
6. The method of claim 1, wherein the oxidizing step is performed at a temperature between about 200°C and about 500°C.
7. The method of claim 1, wherein the halogen-containing gas comprises a halogen-containing compound selected from the group consisting of chlorine, bromine, fluorine, iodine, HCl, HBr, HF, HI, and combinations thereof.
8. The method of claim 1, wherein the halogen-containing gas comprises HCl.
9. The method of claim 1, wherein the halogen-containing gas comprises a halogen-containing compound at a concentration between about 1 vol% and about 100 vol% of the halogen-containng gas.
10. The method of claim 1, wherein the treating step is preformed at a pressure of at least about 1 Torr.
11. The method of claim 1, wherein the treating step is performed at a temperature between about 400°C and about 850°C.
12. The method of claim 1 further comprising reducing the single-wall carbon nanotube material with a gas comprising hydrogen gas.
13. The method of claim 12, wherein the reducing step is performed at a temperature between about 250°C and about 500°C.

14. The method of claim 1 further comprising annealing the single-wall carbon nanotube material.

15. The method of claim 14, wherein the annealing step is performed at a temperature between about 600°C and about 1000°C.

16. The method of claim 14, wheren the annealing step is performed in a vacuum.

17. The method of claim 14 wherein the annealing step is performed with an annealing gas comprising a gas selected from the group consisting of carbon dioxide, inert gases, nitrogen, and combinations thereof.

18. The method of claim 17, wherein the annealing gas comprises water vapor.

19. The method of claim 18, wherein the water vapor is at a concentration of at least about 0.5 vol% of the annealing gas.

20. The method of claim 1 further comprising recovering the single-wall carbon nanotube material to obtain purified single-wall carbon nanotube material, wherein

(a) the single-wall carbon nanotube material comprises single-wall carbon nanotubes, amorphous carbon, and a metallic impurity, and

(b) the amorphous carbon is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

21. The method of claim 20, wherein the amorphous carbon is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

22. The method of claim 20, wherein the amorphous carbon is present in an amount at most about 0.2 wt% of the purified single-wall carbon nanotube material.

23. The method of claim 1 further comprising recovering the single-wall carbon nanotube material to obtain purified single-wall carbon nanotube material, wherein

(a) the single-wall carbon nanotube material comprises single-wall carbon nanotubes, amorphous carbon, and a metallic impurity,

(b) the metallic impurity comprises metal; and

(c) the metal is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

24. The method of claim 23, wherein the metal is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

25. The method of claim 23, wherein the metal is present in an amount at most about 0.1 wt% of the purified single-wall carbon nanotube material.

26. A method for purifying single-wall carbon nanotubes comprising the steps of:

(a) oxidizing a single-wall carbon nanotube material comprising single-wall carbon nanotubes, amorphous carbon, and a metallic impurity in an oxidizing gaseous atmosphere;

(b) reducing the single-wall carbon nanotube material with a reducing gas comprising hydrogen; and

(c) treating the single-wall carbon nanotube material with a halogen-containing gas.

27. The method of claim 26, wherein the oxidizing gaseous atmosphere comprises a gas selected from the group consisting of oxygen, carbon dioxide and mixtures thereof.

28. The method of claim 27, wherein the gas is oxygen and the oxygen is at a concentration at least about 1 vol% of the oxidizing gaseous atmosphere.

29. The method of claim 26, wherein the oxidizing gaseous atmosphere comprises air.

30. The method of claim 26, wherein the oxidizing gaseous atmosphere comprises water vapor.

31. The method of claim 30 wherein the water vapor is at concentration at least about 0.5 vol% of the oxidizing gaseous atmosphere.

32. The method of claim 26, wherein the oxidizing gaseous atmosphere comprises oxygen and water vapor.

33. The method of claim 27, wherein the gas is oxygen and the oxygen is at a concentration between about 10 vol% and about 100 vol% of the oxidizing gaseous atmosphere.

34. The method of claim 26, wherein the oxidizing gaseous atmosphere comprises carbon dioxide.

35. The method of claim 34, wherein the carbon dioxide is at concentration at least about 1 vol% of the oxidizing gaseous atmosphere.

36. The method of claim 27, wherein the oxidizing gaseous atmosphere comprises an a second gas selected from the group consisting of inert gases, nitrogen, and combinations thereof.

37. The method of claim 26, wherein the oxidizing step is performed at a temperature at least about 200°C.

38. The method of claim 26, wherein the halogen-containing gas comprises a gas selected from the group consisting of chlorine, bromine, fluorine, iodine, HCl, HBr, HF, HI, and combinations thereof.

39. The method of claim 26, wherein the halogen-containing gas comprises HCl.

40. The method of claim 26, wherein the halogen-containing gas comprises a halogen-containing compound at a concentration between about 1 vol% and about 100 vol% of the halogen-containing gas.

41. The method of claim 26, wherein the treating step is performed at a pressure between about 1 Torr and about 760 Torr.

42. The method of claim 26, wherein the treating step is preformed at a temperature between about 400°C and about 850°C.

43. The method of claim 26, wherein the reducing step is performed at a temperature between about 250°C and about 500°C.

44. The method of claim 26, wherein the reducing step is performed at a pressure between about 1 Torr and about 760 Torr.

45. The method of claim 26 further comprising annealing the single-wall carbon nanotube material.

46. The method of claim 45, wherein the annealing step is performed at a temperature between about 600°C and about 1000°C.

47. The method of claim 45, wheren the annealing, step is performed in a vacuum.

48. The method of claim 45 wherein the annealing step is performed with an annealing gas comprising a gas selected from the group consisting of carbon dioxide, inert gases, nitrogen, and combinations thereof.

49. The method of claim 48, wherein the annealing gas comprises water vapor.

50. The method of claim 49, wherein the water vapor is at a concentration of at least about 0.5 vol% of the annealing gas.

51. The method of claim 26 further comprising recovering the single-wall carbon nanotube material to obtain purified single-wall carbon nanotube material, wherein

the amorphous carbon is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

52. The method of claim 51, wherein the amorphous carbon is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

53. The method of claim 51, wherein the amorphous carbon is present in an amount at most about 0.2 wt% of the purified single-wall carbon nanotube material.

54. The method of claim 26 further comprising recovering the single-wall carbon nanotube material to obtain purified single-wall carbon nanotube material, wherein

(a) the metallic impurity comprises metal, and

(b) the metal is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

55. The method of claim 54, wherein the metal is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

56. The method of claim 54, wherein the metal is present in an amount at most about 0.1 wt% of the purified single-wall carbon nanotube material.

57. A purified single-wall carbon nanotube material made by the process comprising:

(a) oxidizing a single-wall carbon nanotube material in an oxidizing gaseous atmosphere, wherein the single-wall carbon nanotube material comprises single-wall carbon nanotubes, amorphous carbon, and a metallic impurity;

(b) treating the single-wall carbon nanotube material with a halogen-containing gas; and

(c) recovering the single-wall carbon nanotube material to obtain the purified single-wall carbon nanotube material, wherein the amorphous carbon is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

58. The single-wall carbon nanotube material of claim 57, wherein the amorphous carbon is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

59. The single-wall carbon nanotube material of claim 57, wherein the amorphous carbon is present in an amount at most about 0.2 wt% of the purified single-wall carbon nanotube material.

60. A purified single-wall carbon nanotube material made by the process comprising:

(a) oxidizing a single-wall carbon nanotube material in an oxidizing gaseous atmosphere, wherein the single-wall carbon nanotube material comprises single-wall carbon nanotubes, amorphous carbon, and a metallic impurity and wherein the metallic impurity comprises metal;

(b) treating the single-wall carbon nanotube material with a halogen-containing gas; and

(c) recovering the single-wall carbon nanotube material to obtain the purified single-wall carbon nanotube material, wherein the metal is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

61. The single-wall carbon nanotube material of claim 60, wherein the amorphous carbon is present in an amount at most about 5 wt% of the purified single-wall carbon nanotube material.

62. The single-wall carbon nanotube material of claim 60, wherein the metal is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

63. The single-wall carbon nanotube material of claim 62, wherein the amorphous carbon is present in an amount at most about 1 wt% of the purified single-wall carbon nanotube material.

64. The single-wall carbon nanotube material of claim 60, wherein the metal is present in an amount at most about 0.1 wt% of the purified single-wall carbon nanotube material.

65. The single-wall carbon nanotube material of claim 64, wherein the amorphous carbon is present in an amount at most about 0.2 wt% of the purified single-wall carbon nanotube material.

66. The purified single-wall carbon nanotube material of claim 60, wherein the purified single-wall carbon nanotube material is present in a material selected from the group consisting of composite materials, electrochemical materials, fibers, catalyst supports, films, coatings, and inks.

67. The purified single-wall carbon nanotube material of claim 60, wherein the purified single-wall carbon nanotube material is present in an article comprising a material selected from the group consisting of electrodes of fuel cells, electrodes of capacitors,

electrodes of batteries, electromagnetic shielding materials, radio-frequency shielding materials, radar-absorbing materials, and optically-active materials.

68. The purified single-wall carbon nanotube material of claim 60, wherein the purified single-wall carbon nanotube material is present in an electronic device selected from the group consisting of sensors, field emission cathodes, transistors, pass elements, capacitors, inductors, resistors, connectors, switches, wires, antennae, transducers, and electrical transmission cables.

69. A method for purifying carbon nanotubes comprising:

(a) oxidizing a carbon nanotube material in an oxidizing gaseous atmosphere; and

(b) treating the carbon nanotube material with a halogen-containing gas.

70. A method for purifying carbon nanotubes comprising the steps of:

(a) oxidizing a carbon nanotube material comprising carbon nanotubes, amorphous carbon, and a metallic impurity in an oxidizing gaseous atmosphere;

(b) reducing the carbon nanotube material with a reducing gas comprising hydrogen; and

(c) treating the carbon nanotube material with a halogen-containing gas.